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L9: Entry 1 of 10

File: PGPB

Jun 5, 2003

PGPUB-DOCUMENT-NUMBER: 20030104942

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20030104942 A1

TITLE: All-natural mineral treatment

PUBLICATION-DATE: June 5, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Breau, Kenneth W.	Brantford		CA	

US-CL-CURRENT: 504/150; 504/152

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	RWMC
Draw Desc	Image										

☒ 2. Document ID: US 6217780 B1

L9: Entry 2 of 10

File: USPT

Apr 17, 2001

US-PAT-NO: 6217780

DOCUMENT-IDENTIFIER: US 6217780 B1

**** See image for Certificate of Correction ****

TITLE: Biocidal compositions for treating water

DATE-ISSUED: April 17, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Denkewicz, Jr.; Raymond P.	Warwick	RI		
Senderov; Ernest E.	Conshohocken	PA		
Grenier; Joseph W.	North Providence	RI		

US-CL-CURRENT: 210/764; 210/192, 210/205

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	RWMC
Draw Desc	Image										

☒ 3. Document ID: US 6149821 A

L9: Entry 3 of 10

File: USPT

Nov 21, 2000

US-PAT-NO: 6149821

DOCUMENT-IDENTIFIER: US 6149821 A

TITLE: Balanced water purification system

DATE-ISSUED: November 21, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Rounds; Rhyta Sabina	Flemington	NJ		
Hsu; Tsui-Ling	Edison	NJ		

US-CL-CURRENT: 210/754; 206/524.7, 210/169, 210/764, 252/175, 422/37

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KMIC

☐ 4. Document ID: US 6120698 A

L9: Entry 4 of 10

File: USPT

Sep 19, 2000

US-PAT-NO: 6120698

DOCUMENT-IDENTIFIER: US 6120698 A

**** See image for Certificate of Correction ****

TITLE: Balanced water purification composition

DATE-ISSUED: September 19, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Rounds; Rhyta Sabina	Flemington	NJ		
Hsu; Tsui-Ling	Edison	NJ		

US-CL-CURRENT: 252/181; 210/724, 210/754, 210/759, 252/175, 422/28

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KMIC

☐ 5. Document ID: US 6093422 A

L9: Entry 5 of 10

File: USPT

Jul 25, 2000

US-PAT-NO: 6093422

DOCUMENT-IDENTIFIER: US 6093422 A

**** See image for Certificate of Correction ****

TITLE: Biocidal compositions for treating water

DATE-ISSUED: July 25, 2000

INVENTOR-INFORMATION:

☒ 8. Document ID: US 4882072 A

L9: Entry 8 of 10

File: USPT

Nov 21, 1989

US-PAT-NO: 4882072

DOCUMENT-IDENTIFIER: US 4882072 A

**** See image for Certificate of Correction ****

TITLE: Method and apparatus for treating bodies of water

DATE-ISSUED: November 21, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Eberhardt; Thomas E.	Easton	PA	18042	

US-CL-CURRENT: 210/252; 210/242.1, 210/256, 210/257.1, 210/258, 210/739, 210/918

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	KMIC
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☐ 9. Document ID: US 4877524 A

L9: Entry 9 of 10

File: USPT

Oct 31, 1989

US-PAT-NO: 4877524

DOCUMENT-IDENTIFIER: US 4877524 A

TITLE: Apparatus for treating bodies of water

DATE-ISSUED: October 31, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Eberhardt; Thomas E.	Easton	PA	18042	

US-CL-CURRENT: 210/242.1; 144/264, 144/61

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	KMIC
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☐ 10. Document ID: US 4818416 A

L9: Entry 10 of 10

File: USPT

Apr 4, 1989

US-PAT-NO: 4818416

DOCUMENT-IDENTIFIER: US 4818416 A

**** See image for Certificate of Correction ****

TITLE: Method and apparatus for treating bodies of water

DATE-ISSUED: April 4, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Eberhardt; Thomas E.	Easton	PA	18042	

US-CL-CURRENT: 210/749; 210/198.1, 210/242.1

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	KWIC
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L9: Entry 1 of 10

File: PGPB

Jun 5, 2003

PGPUB-DOCUMENT-NUMBER: 20030104942
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030104942 A1

TITLE: All-natural mineral treatment

PUBLICATION-DATE: June 5, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Breau, Kenneth W.	Brantford		CA	

APPL-NO: 10/ 051444 [PALM]
DATE FILED: January 18, 2002

RELATED-US-APPL-DATA:

Application is a non-provisional-of-provisional application 60/334254, filed
November 30, 2001,

INT-CL: [07] A01 N 59/00, A01 N 55/02

US-CL-PUBLISHED: 504/150; 504/152

US-CL-CURRENT: 504/150; 504/152

ABSTRACT:

The invention relates to a treatment for the control of algae in aquatic environments. The treatment includes an algicide in combination with at least one of a pH stabilizer, a clarifier, and a sanitizer reducer/enhancer.

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L9: Entry 2 of 10

File: USPT

Apr 17, 2001

DOCUMENT-IDENTIFIER: US 6217780 B1

**** See image for Certificate of Correction ****

TITLE: Biocidal compositions for treating water

Abstract Text (1):

The present invention is directed to a biocidal water treatment composition, water treatment apparatus, and method of treating water to reduce levels of pathogens. The composition contains sources of copper, zinc, and silver metal ions within a crosslinked polymer matrix. Examples of these ion sources include copper sulfate, zinc sulfate, and silver nitrate. An example of the crosslinked polymer matrix is crosslinked chitosan, which also serves to clarify the water and release the metal ions over time. The product is easy to manufacture, and allows the use of decreased halogen sanitizer, as well as decreased copper ion, thereby decreasing the likelihood of staining. The product simultaneously provides good bactericidal and algacidal properties, despite low levels of copper ion and low chlorine levels.

Brief Summary Text (13):

For these and other reasons, it is desirable to reduce the quantity of chlorine needed and used to achieve an acceptably low level of microorganisms in swimming pools, hot tubs, spas, etc. A variety of compositions have been suggested for this purpose, including compositions containing heavy metal ions such as copper, silver, zinc, and nickel. Metal ions are known biocides, and have been provided as metal salt-based compositions for the treatment of swimming pools and other bodies of water. In particular, water soluble inorganic salts of copper, such as copper sulfate, copper nitrate, and copper chloride, have been suggested for use as algacides and/or bactericides for the treatment of water.

Brief Summary Text (14):

The use of copper or copper ion sources, however, presents several disadvantages. Copper ions react with naturally occurring anions in alkaline or near-alkaline water, and precipitate as insoluble salts of, e.g., carbonate, oxide, and/or hydroxide. Copper precipitation is also sensitive to pH. Precipitation leads to a loss of biocidal activity as the copper ions are no longer available in solution. Precipitation also causes aesthetic problems including turbidity of water and the formation of stains on surfaces, such as pool surfaces. Conventional wisdom has been that, at copper levels sufficiently high to have a significant biocidal effect, it is necessary to add complexing agents having ligands that coordinate with the copper ion in order to shield the ion from the anions in solution thereby keeping it from precipitating and available for biocidal action See U.S. Pat. No. 5,632,904. A variety of sequestering agents have been used to enhance the stability of the copper ions in solution in this way. For example, EDTA (ethylene diamine tetra acetic acid), citric acid, and salicylic acid are known to stabilize copper ions in solution by sequestering them. However, these sequestrants can be broken down in the presence of oxidizing agents such as chlorine, which will generally still be necessary in some quantities despite the use of metal biocides. In addition, sequestrants can bind metal ions so strongly that the biocidal activity of the ions is inhibited. These factors render the use of sequesterant-containing biocides complicated and difficult for the average pool user.

Brief Summary Text (15):

In addition, copper salt biocides are more effective against algae than against bacteria and other pathogens. In order to obtain significant bactericidal activity

from copper salt biocides, unreasonably high copper concentrations are necessary. As a result, copper salt containing biocides are generally suitable as algaecides, requiring the use of additional biocides to control bacteria and other pathogens.

Brief Summary Text (29):

This combined effect of silver ions and zinc ions in permitting a reduction of the copper and chlorine levels is unexpected, and is used in the present invention to provide a biocidally effective composition that advantageously avoids the staining of surfaces that contact the water, but not by adding large quantities of organic sequestrants, which can later be broken down by the strong oxidizing agents in the water, requiring constant replenishment (which generally is accomplished by adding additional sequesterant complexed with yet more copper ion). Instead, the present invention makes use of the surprising effect of silver and zinc ions, in conjunction with copper ions, in maintaining a high degree of biocidal effectiveness, particularly algaecidal effectiveness and bactericidal effectiveness, despite substantially decreased copper ion concentrations. This allows the copper ion concentration in the water to be maintained at a sufficiently low level that precipitation is minimize or eliminated entirely, and in any case, staining is avoided. Accordingly, the composition of the present invention provides a metal salt-based biocide that represents a significant advance over what has previously been available in the art. One significant advantage of the present invention is that it provides effective destruction and/or growth inhibition of both bacteria and algae, and is not limited in its effectiveness to one or the other.

Brief Summary Text (30):

As indicated above, the relative abundance of zinc ion source and silver ion source allow the use of an amount of copper ion source significantly lower than would have been thought to be required, and provides good bactericidal and algaecidal control while still reducing staining. The ratio of zinc ion source to copper ion source (by weight based on zinc and copper atoms) can range from about 0.5:1 to about 4:1. The ratio of silver ion source to copper ion source (by weight based on silver and copper atoms) can range from about 0.05:1 to about 2:1. As an example, a ratio of zinc ion source to copper ion source of 2.3:1 and a ratio of silver ion source to copper ion source of 0.6:1 have been found to be suitable.

Brief Summary Text (36):

As previously indicated, the present invention is directed to an improved composition, water treatment system, and method for treating bodies of water to inhibit, or reduce the growth of microbes, algae, and/or fungi at reduced chlorine levels without noticeable staining. The composition is prepared by combining metal ion sources, including sources of copper, silver, and zinc ions, optionally with one or more crosslinkable polymers and a crosslinking agent. The presence of zinc and silver ion sources maintains an acceptable biocidal effect even in the presence of decreased amounts of copper and chlorine or hypochlorite. This reduces the risk of the formation of stains on surfaces in contact with water, and avoids turbidity of the water. The crosslinkable polymer and the crosslinking agent are selected so that, when crosslinked, the resulting composition releases ions into solution over a time period ranging from a few hours to several days to a year, and the resulting polymer matrix used to support the metal ion sources also dissolves to clarify the water. The invention is prepared by mixing the various components, forming the resulting composition into various shapes, and drying.

Brief Summary Text (41):

The compositions according to the present invention are prepared by combining the metal ion sources discussed above with one or more crosslinkable polymers, which can then be crosslinked. The resulting polymer is temporarily crosslinked by anionic bridges, and forms a three-dimensional network or matrix that supports the metal ion sources, and immobilizes them to a certain extent, while allowing them to slowly dissolve into the water to be treated. In addition, the polymer matrix itself can clarify the water. While not wishing to be bound by any theory, it is believed that the polymer matrix, which desirably contains cationic moieties thereon, dissolves into the water over a period of a few days to a year, depending upon the amount of polymer added to the water. In quantities used in most swimming pool, hot tub, and spa applications, the composition is generally completely dissolved in well under three days in the water, and generally dissolves in a few hours. It is believed that

the cationic moieties of the dissolved polymer molecules electrostatically attract and agglomerate colloidal and suspended particles in the water that individually are sufficiently small to avoid settling by precipitation and becoming trapped by the pool filter. These particles combine with the dissolved polymer to form agglomerates of sufficient size to be trapped by the pool filter, clarifying the water. Neither the dissolved polymer matrix nor the copper ion of the present invention are believed to be present in sufficiently high concentrations for the polymer to sequester significant amounts of copper ions.

Brief Summary Text (46):

The inclusion of both chitosan salt and chitosan-gel makes manufacture of the material significantly easier and contributes to the clarity of the water treated with the composition, as both function as water clarifiers. Specifically, chitosan-gel provides moisture to the composition that allows formation of a paste during manufacture, thereby allowing the composition to be easily extruded and/or formed into a variety of shapes, such as monoliths, pellets, tablets, or sticks. In addition, the chitosan-gel acts as a binder, which permits the composition to solidify. Chitosan salt powder provides additional chitosan to the composition while preventing it from getting too wet during manufacture. As a result, chitosan salt powder and chitosan-gel are advantageously used in combination, as described above. Specifically, chitosan powder alone may not produce sufficient binding of the composition, and the use of chitosan-gel alone may not allow the composition to dry to a solid when chitosan-gel is added at the level needed to act as a water clarifier.

Brief Summary Text (51):

This simple preparation process results in a water treatment composition comprising a combination of metal salts disposed within a matrix of cross-linked polymers. The matrix is formed by polymerization of one or more monomers, followed by crosslinking, or by crosslinking of the crosslinkable polymer by the crosslinking agent. For instance, when the crosslinkable polymer is chitosan, the sulfate anions of both the zinc and copper sulfate salts, as well as sulfuric acid, contribute to the crosslinking. When placed in contact with water, metal ions comprising the present invention are leached from the composition over time. Components of the composition that are more slowly soluble, like the crosslinked chitosan, or that are relatively insoluble, are also released into the water, acting as water clarifiers. Chitosan and chitosan-gel are both effective water clarifiers, as discussed above. The preparation process is conducted under ambient temperature and pressure conditions, and no special precautions need to be taken.

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L9: Entry 3 of 10

File: USPT

Nov 21, 2000

DOCUMENT-IDENTIFIER: US 6149821 A

TITLE: Balanced water purification system

Abstract Text (1):

A balanced water purification system is provided with a buffer compound, and oxidizer/clarifier compound, and a biocide compound disposed in multiple packets such that the biocide compound and the oxidizer/clarifier compound are contained in different packets. The composition purifies and clarifies water while maintaining the existing water pH. The composition may also include a filtration aid, an algicide, a calcium releasing source, a chelator, and a sequestering agent.

Brief Summary Text (2):

The present invention relates generally to chemical compositions used in the purification, clarification, and stabilization of water and waste water, methods for making the compositions, and methods for using the compositions. More specifically, the present invention relates to chemical compositions, methods for making the compositions, and methods for using the compositions in the purification, clarification, and stabilization of recreational waters such as swimming pool, spa, or hot-tub water.

Brief Summary Text (6):

Combinations of two or more chemicals attempt to improve the ease and reliability of chemical treatments for clarifying or disinfecting water. For example, U.S. Pat. No. 5,501,802 to Thorpe et al. discloses a composition containing a polyhexamethylene biguanide sanitizer, persulfate salt oxidizers, and chelating agents. The composition is used to achieve water clarity. U.S. Pat. Nos. 5,514,287 and 5,478,482, both to Jones et al., disclose a composition and a method for controlling microbial growth in recirculating water systems. The composition includes a soluble boron contributor, a halogen/boron sanitizer/algicide, and an oxidizing clarifier having a chlorine compound, a non-halogen oxidizer, and a boron source. Finally, U.S. Pat. No. 4,846,979 to Hamilton discloses an algicide composition for treating swimming pools and spas including and alkali metal, alkaline earth metal or ammonium bromide and an oxidizer. The composition is metered in over time to maintain a desired bromine concentration. These chemical combinations are not complete water quality treatments. Further, the addition of these chemicals causes other water quality parameters to change, such as pH, requiring additional chemical treatment to compensate for the addition of these chemicals.

Brief Summary Text (7):

In other applications, for example swimming pools and spas, chemical combinations attempt to provide a complete water quality treatment. For example, U.S. Pat. No. 5,700,377 to Cox discloses a complete treatment for the purification of water in non-porous swimming pools, obviating the need for the addition of any other compounds to the water. The complete treatment chemical composition of Cox includes a peroxide compound, an ammonium-based biocidal compound, an acidic compound, a basic compound, a calcium-releasing basic compound, and EDTA. The composition is added to the water when the pH of that water is outside the human comfort zone of 7.2 to 7.6 in order to bring the pH within the zone range. Therefore, water clarification is combined with pH adjustment.

Brief Summary Text (8):

The need exists for a composition that acts as a biocide, oxidizer, clarifier, and

algicide and does not interfere with the overall maintenance of the water. Since water conditions vary from application to application, the composition of the present invention is formulated to provide purification and clarification without adversely affecting concurrent treatment. Benefits include ease of operation for a consumer in pool or spa applications, decreased costs to industry in terms of chemicals and training and time in an industrial process or waste application, and decreased costs to municipal water supplies with limited budgets, space, and equipment. The present composition and treatment method is useful in a variety of applications including home water treatment, community water treatment, industrial water treatment (both waste water and process water), agriculture, water reuse, groundwater injection, and recreational water applications.

Brief Summary Text (11):

When added to water independently maintained at a predetermined pH and having a certain temperature range, the compositions do not change the pH of the water. The compositions include a buffer compound having an acidic component and a basic component, the acidic and basic components being present in amounts such that the molar ratio of the acidic component to the basic component yields a buffer compound whose pH in solution corresponds to the predetermined pH of the water to be purified, a biocide compound present in an amount sufficient to inactivate the microorganisms in the water to be purified, and an oxidizer/clarifier compound present in an amount sufficient to oxidize the biocide precursor completely. The acidic component includes, but is not limited to, sodium bisulfate. The basic component includes, but is not limited to, sodium bicarbonate and sodium carbonate.

Brief Summary Text (12):

In one formulation of the compositions, the acidic component is sodium bisulfate, the basic component is sodium bicarbonate and the molar ratio of sodium bisulfate to sodium bicarbonate is about 0.26 to about 0.14, corresponding to a buffer compound pH in solution from about 6.8 up to about 7.2. In another formulation, the acidic component is sodium bisulfate, the basic component is sodium bicarbonate, and the molar ratio of sodium bisulfate to sodium bicarbonate is about 0.18, corresponding to a buffer compound pH in solution of about 7.

Brief Summary Text (14):

In other formulations, the weight ratio of the acidic component to the basic component compensates for an increase in the pH of the water over time associated with water systems exposed to the atmosphere. For example, the acidic component can be sodium bisulfate, the basic component sodium bicarbonate, and the weight ratio of sodium bisulfate to sodium bicarbonate about 1.5 to yield a buffer pH of about 4. Alternatively, the acidic component can be sodium bisulfate, the basic component sodium carbonate, and the weight ratio of sodium bisulfate to sodium carbonate about 2.27.

Brief Summary Text (16):

The oxidizer/clarifier compound includes a peroxide, potassium monopersulfate, alkali metal perborate, or alkali metal persulfate. Preferably, the oxidizer/clarifier compound is sodium persulfate or potassium persulfate. The oxidizer/clarifier compound can be present in the composition in an amount from about 38 up to about 64 weight percent. In one formulation, the oxidizer/clarifier compound is present in an amount sufficient to oxidize the biocide compound completely and to oxidize organic contaminants in the water to be purified. In this case, the molar ratio of the oxidizer/clarifier compound to the biocide precursor is greater than about 1.

Brief Summary Text (17):

In terms of concentration in the water, the oxidizer/clarifier compound is present in the composition in an amount such that when the composition is added to water the concentration of the oxidizer/clarifier compound in the water is from about 2 up to about 9 parts per million. Preferably, the concentration of the oxidizer/clarifier in the water is about 5 ppm.

Brief Summary Text (18):

In one formulation, the biocide precursor is ammonium chloride and is present in the composition from about 18 up to about 23 weight percent. The oxidizer/clarifier

compound is sodium persulfate and is present in the composition from about 50 up to 64 weight percent, and the weight ratio of sodium persulfate to ammonium chloride is about 2.8. In another formulation, the biocide compound is sodium bromide and is present from about 25 up to about 35 weight percent. The oxidizer/clarifier compound is sodium persulfate and is present from about 38 up to about 52 weight percent, and the weight ratio of sodium persulfate to sodium bromide is about 1.48.

Brief Summary Text (19):

The balanced water purification composition may include additional compounds including an algicide. The algicide includes copper sulphate, copper citrate, copper EDTA (ethylene diaminetetraacetic acid), copper gluconate, silver nitrate, colloidal silver, silver metal deposit on aluminum, quaternary (quats) or polyquaternary (polyquats) ammonium compounds (e.g. poly[oxyethylene (dimethylimino) ethylene (dimethylimino) ethylene dichloride]), sodium dimethyldithiocarbamate, 2-chloro-4,6-bis(ethylamino)-5-triazine, zinc chloride, or zinc oxides. In one formulation, the algicide is copper sulphate and is present from about 1 up to about 2 weight percent. In another formulation, the algicide is copper citrate and is present from about 1.5 up to about 2 weight percent. The copper citrate can be formed in-situ by combining copper sulphate and sodium citrate in the composition in about a 1 to 1 molar ratio.

Brief Summary Text (21):

In one formulation of the balanced water purification composition, the acidic component is sodium bisulfate and is present in an amount from about 1.6 to about 6.1 weight percent. The basic component is sodium bicarbonate present in an amount from about 5.9 to about 22.4 weight percent. The weight ratio of sodium bisulfate to sodium bicarbonate is about 0.27. The biocide compound is ammonium chloride and is present in an amount from about 18 up to about 23 weight percent. The oxidizer/clarifier compound is sodium persulfate present in an amount from about 50 to about 64 weight percent, and the weight ratio of sodium persulfate to ammonium chloride is about 2.8. This formulation may also include copper sulphate in an amount from about 1 up to about 2 weight percent.

Brief Summary Text (22):

In another formulation of the balanced water purification composition, the acidic component is sodium bisulfate and is present in an amount from about 2.7 up to about 7.6 weight percent. The basic component is sodium bicarbonate and is present in an amount from about 10 up to about 28 weight percent. The weight ratio of sodium bisulfate to sodium bicarbonate is about 0.27. The biocide compound is sodium bromide present in amount from about 25 up to about 35 weight percent. The oxidizer/clarifier compound is sodium persulfate present in an amount from about 38 up to about 52 weight percent, and the weight ratio of sodium persulfate to sodium bromide is about 1.48. This formulation may also include copper sulfate present from about 1 up to about 2 weight percent or copper citrate from about 1 up to about 2 weight percent.

Brief Summary Text (24):

The method for making the balanced water purification composition to be used in conjunction with existing water treatment without affecting the pH of the water includes determining the pH and temperature range of the water to be treated, formulating a buffer compound having an acidic component and a basic component present in a molar ratio corresponding to the pH of the water to be treated, adding a sufficient amount of a biocide compound to inactivate the biological contaminants in the water, and adding a sufficient amount of a clarifier/oxidizer compound to oxidize the biocide precursor completely and to oxidize organic contaminants in the water. This method of making also includes adding a predetermined amount of the composition to a water soluble film or laminated film bag, where the water soluble film bag includes polyvinyl alcohol, a cellulosic fiber, polyethylene oxide, or laminates thereof. The balanced water purification composition can be used in purifying and clarifying recreational waters.

Brief Summary Text (25):

The composition can be packaged into a system including a plurality of packets. In one embodiment, no one of the plurality of packets comprises all of the compounds of the composition. However, when combined, the plurality of packets will comprise the

entire composition. In another embodiment, the biocide compound and the oxidizer/clarifier compound are held in different packets. The plurality of packets can include a first packet having the biocide compound and a second packet having the oxidizer compound. The first packet may also include the basic component of the buffer compound, and the second packet may also include the acidic component of the buffer compound. The plurality of packets may include exactly two packets, and the packets may be water soluble film bags.

Detailed Description Text (2):

The composition of the present invention includes an oxidizer/clarifier compound, a biocide compound, and a buffer compound. The buffer compound includes an acidic component and a basic component. The composition is typically made from inorganic salts. Generally, these salts dissociate upon addition to water, affecting water balance including pH, total alkalinity, and hardness. The composition of the present invention, however, is formulated to provide water clarification and purification in conjunction with an existing overall water maintenance program without adversely affecting other water quality parameters. Therefore, given a predetermined water pH and water temperature range, the molar ratios of the compounds and components of the composition of the present invention are calculated from their dissociation constants to yield a pH in solution equivalent to the predetermined pH of the water to be treated. The calculated molar ratios are used to determine the weight percent ratios of the components (i.e. molar ratios of dissociated species determine the weight ratios of compounds and the components). Therefore, water balance is maintained when the composition so formulated is added to the water.

Detailed Description Text (3):

The buffer compound is formulated to have a pH in solution corresponding to the pH of the water to be treated. Therefore, the type and weight percent of the acidic component and the basic component of the buffer compound are selected to provide the desired pH at the appropriate water temperature. The basic component includes, but is not limited to, sodium bicarbonate and sodium carbonate. The acidic component includes, but is not limited to sodium bisulfate. Typically, the buffer compound includes sodium bisulfate and at least one of sodium bicarbonate and sodium carbonate. The buffer compound may also include phosphates such as monopotassium phosphate, monobasic sodium phosphates, and citrate-phosphate blends.

Detailed Description Text (4):

In order to achieve the desired buffer solution pH, the molar ratio of the acidic component to the basic component is calculated. Calculation of the molar ratio is governed by the following reactions describing the carbonate system and showing the generation of bicarbonate and carbonate ions respectively: $\text{H}_2\text{CO}_3 \rightleftharpoons \text{H}^+ + \text{HCO}_3^-$ and $\text{HCO}_3^- \rightleftharpoons \text{H}^+ + \text{CO}_3^{2-}$ where K_{a1} and K_{a2} are the dissociation constants. Given a desired pH of the water at a given temperature, the molar ratios can be determined. By way of illustration, using a sodium bicarbonate basic component at a pH of about 7 and a water temperature of about 25.degree. C., the dissociation constants are $K_{a1} = 4.45 \times 10^{-7}$, and $K_{a2} = 4.7 \times 10^{-11}$. Solving the equation:

Detailed Description Text (6):

In general, for a buffer compound utilizing sodium bisulfate, sodium bicarbonate, or sodium carbonate in water having a temperature from about 20.degree. C. up to about 30.degree. C. and a pH from a pH of about 4 up to a pH of about 10 the following molar ratios apply. For a pH of 4, the initial molar ratio of sodium bisulfate to sodium bicarbonate is about 1. At this pH, no sodium carbonate is required. As the pH increases to about 8.3, this molar ratio decreases until only sodium bicarbonate is required at a pH of about 8.3. Above a pH of 8.3, sodium carbonate is required in addition to sodium bicarbonate. As the pH increases from about 8.3 up to about 10, the initial ratio of sodium carbonate to sodium bicarbonate increases up to about 0.47. In one embodiment, the buffer compound includes sodium bisulfate as the acidic component, sodium bicarbonate as the basic component, a water temperature range from about 20.degree. C. up to about 30.degree. C., and an initial molar ratio of sodium bisulfate to sodium bicarbonate from about 0.26 for a pH of about 6.8 to a molar ratio of about 0.14 for a pH of about 7.2.

Detailed Description Text (7):

After the acidic and basic components are selected and their molar ratios are

calculated based upon pH and temperature, the initial molar ratios are converted to weight percent ratios based upon the molecular weights of the components. In one embodiment, the acidic component is sodium bisulfate, the basic component is sodium bicarbonate, and the weight ratio of sodium bisulfate to sodium bicarbonate is about 0.27, corresponding to a pH of about 7. This embodiment is useful for recreational water applications such as swimming pool water. In another embodiment, the acidic component is sodium bisulfate, the basic component is sodium carbonate, and the weight percent ratio of the sodium bisulfate to the sodium carbonate is about 1.34, also corresponding to a pH of about 7. Although the buffer compound in the preceding embodiments has enough buffering capacity to assist in maintaining the pH of the water over time and to account for changes in the pH of the water due to the addition of other chemicals, the pH in a water system that is open to the atmosphere will tend to increase over time. Therefore, an acidic variant of the buffer compound can be specifically formulated to compensate for this increase. In one embodiment of the acidic variant, the acidic component is sodium bisulfate, the basic component is sodium bicarbonate, and the weight ratio of sodium bisulfate to sodium bicarbonate is about 1.5, corresponding to a pH of about 4. In another embodiment of the acidic variant, the acidic component is sodium bisulfate, the basic component is sodium bicarbonate, and the weight ratio of sodium bisulfate to sodium bicarbonate is about 3.1, corresponding to a pH of about 2.78. In yet another embodiment of the acidic variant, the acidic component is sodium bisulfate, the basic component is sodium carbonate and the weight ratio of sodium bisulfate to sodium carbonate is 2.27, corresponding to a pH of about 4. Similarly, the buffer compound can be formulated as a basic variant. In one embodiment of the basic variant, the acidic component is sodium bisulfate, the basic component is sodium carbonate and the weight ratio of sodium bisulfate to sodium carbonate is about 0.77, corresponding to a pH of about 10.

Detailed Description Text (11):

The oxidizer/clarifier compound is added to oxidize organic matter in the water and to oxidize the biocide compound, for example oxidizing chloride to chlorine and bromide to bromine. The oxidizer/clarifier compound includes peroxides, hydrogen peroxide, potassium monopersulfate, and alkali metal perborate. In a preferred embodiment, the oxidizer/clarifier compound is an alkali metal persulfate. In a more preferred embodiment, the alkali metal persulfate is sodium persulfate or potassium persulfate. In a most preferred embodiment, the alkali metal persulfate is sodium persulfate.

Detailed Description Text (12):

The oxidizer/clarifier compound is present in an amount necessary to oxidize the organic matter present in the water, to oxidize the biocide precursor compound completely, and to maintain a oxidizer/clarifier residual in the water necessary to oxidize any organic material that may be subsequently introduced into the water. In one embodiment, the oxidizer/clarifier compound is present in the composition in an amount from about 38 weight percent up to about 64 weight percent. In another embodiment, the oxidizer/clarifier compound is present on the composition in an amount from about 50 up to about 64 weight percent. In yet another embodiment, the oxidizer clarifier compound is present in the composition in an amount from about 38 up to about 52 weight percent. In a preferred embodiment, the oxidizer/clarifier compound is present in the composition in an amount sufficient to achieve a concentration in the water of the oxidizer/clarifier compound from about 2 up to about 9 parts per million (ppm). In a more preferred embodiment, the oxidizer/clarifier compound is present in the composition in an amount sufficient to achieve a concentration in the water of the oxidizer/clarifier compound of about 5 ppm.

Detailed Description Text (13):

In order for the oxidizer/clarifier compound to oxidize the biocide compound, the amount of the oxidizer/clarifier compound in the composition is selected to be more than that of the biocide compound in the composition. The molar ratio of the oxidizer/clarifier compound to the biocide compound is formulated to be at least 1 to 1 with any excess persulfate oxidizing the organic matter present in the water. By way of example, assume the conversion of chloride to chlorine by persulfate is governed by the reaction:

Detailed Description Text (14):

In order to have a sufficient amount of persulfate to oxidize the biocide and the organic matter, the persulfate to chlorine ratio ($S_{sub.2} O_{sub.8} sup.2- / Cl_{sub.2}$) is greater than 1:1 in the water, for example, about 1 to 0.8, is selected, yielding a molar ratio of persulfate to chloride ($S_{sub.2} O_{sub.8} sup.2- / Cl_{sup.-}$) in the composition of about 1 to 1.6. This yields a weight ratio of sodium persulfate to ammonium chloride in the composition of about 2.8. In a preferred embodiment, the oxidizer/clarifier is sodium persulfate, the biocide is ammonium chloride, and the weight ratio of sodium persulfate to ammonium chloride is about 2.8. In a more preferred embodiment, the oxidizer/clarifier is sodium persulfate, the biocide is sodium bromide, and the weight ratio of sodium persulfate to sodium bromide is 1.48.

Detailed Description Text (15):

Although not required in the composition of the present invention to provide purification, disinfection, and clarification without adversely affecting the existing water balance, additional compounds may be added to the composition of the present invention in response to application specific water quality demands. These additional compounds include algicides, calcium releasing compounds, chelators, scale inhibitors, sequestering agents, and filtration aids (i.e. coagulants and flocculants).

Detailed Description Text (16):

In applications where algae growth is a concern, an algicide compound may be added to control the growth of the algae. This is true, for example, of applications exposed to the environment. The algicide compound includes metal complexes such as copper sulphate, copper citrate, copper EDTA, and copper gluconate, silver nitrate, colloidal silver, silver metal deposits on aluminum, polyquats such as poly[oxyethylene (dimethylimino) ethylene (dimethylimino) ethylene dichloride], quats, sodium dimethyldithiocarbamate, and 2-chloro-4,6-bis(thylamino)-5-triazine, and zinc compounds such as zinc chloride and zinc oxides. In a preferred embodiment, the algicide is copper sulfate. In a more preferred embodiment, the algicide is copper citrate. In a most preferred embodiment, the copper citrate is formed in-situ by combining copper sulfate and sodium citrate together in the composition in a 1:1 molar ratio. The algicide is present in the composition in an amount from about 1 weight percent up to about 2 weight percent.

Detailed Description Text (18):

In order to formulate the composition of the present invention, the desired water quality for the particular application is determined. The acidic and basic components are selected, and based upon the pH and temperature of the water, the molar ratio of the acidic component to the basic component of the buffer compound is calculated. This molar ratio yields a working weight percent range for the buffer compound to use in the formulation of the composition. The amount of the selected biocide compound is calculated based upon the anticipated biocide demand in the water and any required or desired biocide residual in the water. Next, the molar ratio of the desired oxidizer/clarifier compound to the biocide compound is calculated to provide a molar excess of the oxidizer/clarifier compound to the biocide compound sufficient to oxidize the biocide completely and to meet the oxidant demand of the organic matter in the water. Based upon this molar ratio, the weight percents of oxidizer/clarifier and biocide are calculated from their molecular weights. The weight ratios of the acidic component, basic component, biocide compound, and oxidizer/clarifier compound are maximized and minimized within working ranges of efficacy to yield weight percent ranges for each constituent in a particular embodiment of the composition. Finally, additional chemical compounds such as algicides, calcium releasing compounds, chelators, scale inhibitors, sequestering agents, and filtration aids are added to the composition based upon the needs of the water in the specific application. Once formulated, the composition is packaged to permit easy and reliable addition into the water to be treated. The packaging includes bulk powders, aqueous solutions, tablets, or packets.

Detailed Description Text (22):

Any number of packets are possible in the multiple packet system, such as one packet for each of the compounds and components in the composition or various packets containing sub-combinations of the compounds and components. In one embodiment, the

composition is contained in at least two packets such that the biocide compounds and the oxidizer/clarifier compounds are contained in separate packages. In a preferred embodiment, the packet containing the biocide compound also includes the basic component of the buffer compound. In a more preferred embodiment, the multiple packets include two packets, the first packet including the biocide compound and the basic component of the buffer compound and the second packet containing the oxidizer/clarifier compound, the acidic component of the buffer compound, and any additional compound. Alternatively, additional inert additives, such as sodium citrate, EDTA sodium salts, or basic alkali metal salts of phosphates may be included in the first packet containing the biocide compound. Alternatively, the second packet may include citric acid, EDTA, or acidic alkali metal salts of phosphates. Although multiple packets in accordance with the present invention can be used for any chemical composition, the preferred embodiment includes balanced water treatment compositions formulated in accordance with the present invention.

Detailed Description Text (32):

In this example the persulfate/chloride weight ratio is again 2.8; however, the bisulfate/bicarbonate weight ratio is increased to 1.5. This acidic variant of the composition is intended to compensate for a water system that is open to the environment causing the pH to increase over time. The acidic variant controls a pH rise that is greater than the buffering capacity of the variant in Example 1. The acid/base dissociation pairs are formulated based upon a pH of about 4.

Detailed Description Text (46):

In this formulation, the weight ratio of sodium persulfate to ammonium chloride is 2.8, and the weight ratio of sodium bisulfate to sodium bicarbonate is 0.27. Copper citrate is substituted for copper sulphate as an algicide. Copper citrate is a preferred algicide because it is less sensitive to pH and total alkalinity than copper sulphate, the chelating effect of citrate prevents Cu.sup.2+ from precipitating, algae control is comparable to copper sulphate, copper citrate has a greater potential for eliminating discoloration, and citrate is biodegradable when the pH is required to be 6.1. Copper citrate may be formed in-situ by adding copper sulfate and sodium citrate together in the composition in a 1:1 molar ratio. This formulation is based upon a pH of about 7.

Detailed Description Text (48):

The weight ratio of sodium persulfate to sodium bromide is 1.48, and the weight ratio of sodium bisulfate to sodium bicarbonate is 0.27. Copper citrate is substituted for copper sulphate as an algicide for the reasons indicated above in Example 11. This formulation is based upon a pH of about 7.

Detailed Description Text (52):

In examples 13, 14, and 15, sodium carbonate is substituted for sodium bicarbonate as the basic component of the buffer compound. The weight ratio of sodium bisulfate to sodium carbonate is 1.34 for all three examples. The weight ratio of sodium persulfate to ammonium chloride is 2.8, and the weight ratio of sodium persulfate to sodium bromide is 1.48. These three examples are based upon a pH of about 7.

Detailed Description Text (70):

The stability and higher solubility of the copper citrate algicide versus copper sulfate was demonstrated across varying pH and total alkalinity. The actual measurements were made at higher concentrations to amplify the response of the aqueous solutions. The concentrations of both the copper citrate and copper sulfate were 0.0025 M. The greater stability of copper citrate with respect to varying total alkalinity is shown in Table 3. The greater stability of copper citrate with respect to varying pH is shown in Table

Detailed Description Text (71):

A formulation of the balanced water purification composition containing copper citrate as the algicide was also compared to Chlor-Free.TM. for stability. The results are listed in Table 5.

CLAIMS:

1. A method for making a balanced water purification system to be used in

conjunction with existing water treating without changing the pH of the water to which it is added, comprising:

- a) determining the pH and temperature range of the water to be treated;
- b) preparing a balanced water treatment composition by:
 - i) formulating a buffer compound having an acidic component and a basic component present in a molar ratio equivalent to the pH of the water to be treated;
 - ii) adding a sufficient amount of a biocide compound to inactivate the biological contaminants in the water; and
 - iii) adding a sufficient amount of a clarifier/oxidizer compound to oxidize the biocide compound completely and to oxidize organic matter in the water; and
- c) placing the balanced water treatment composition in a plurality of packets.

3. The method of claim 2 wherein the biocide compound and the oxidizer/clarifier compound are held in different packets.

6. A balanced water purification system for addition to, and purification of, water independently maintained at a predetermined pH and having a certain temperature range without changing the pH of the water, comprising:

- a) a balanced water purification composition, comprising:
 - i) a buffer compound comprising:
 - A) an acidic component; and,
 - B) a basic component, wherein the acidic and the basic components are each present in an amount sufficient to provide a molar ratio of the acidic component to the basic component that yields a buffer compound having pH in solution equivalent to the existing pH of the water to be purified;
 - ii) a biocide compound present in an amount sufficient to inactivate biological contaminants in the water to be purified; and
 - iii) an oxidizer/clarifier compound present in an amount sufficient to oxidize the biocide compound completely; and
- b) a plurality of packets for holding the composition.

8. The balanced water purification system of claim 7 wherein the biocide compound and the oxidizer/clarifier compound are held in different packets.

14. The balanced water purification system of claim 6 wherein said acidic component is sodium bisulfate, said basic component is sodium bicarbonate and the molar ratio of sodium bisulfate to sodium bicarbonate is about 0.26 to about 0.14, corresponding to said buffer compound pH in solution from about 6.8 to about 7.2.

16. The balanced water purification system of claim 6, wherein said oxidizer/clarifier compound is a peroxide, alkali metal perborate, or alkali metal persulfate.

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L9: Entry 6 of 10

File: USPT

Mar 19, 1996

DOCUMENT-IDENTIFIER: US 5500131 A

**** See image for Certificate of Correction ****

TITLE: Compositions and methods for water treatment

Brief Summary Text (3):

Previous attempts to clarify and purify eutrophic waters have often enlisted the use of toxic substances to kill the microorganisms which flourish therein. Other disadvantages, in addition to toxicity, result from this approach. In most cases, the biocidal effect of these toxic substances is incomplete, which allows a rapid recovery by the microorganisms. Thus, the results are only temporary and are generally ineffective.

Brief Summary Text (6):

Scientific studies show copper is toxic, and prolonged use breeds copper resistant strains of algae. Recent public concern over environmental and economic issues are expected to ultimately result in a reduction in the use of copper as an algicide. Municipalities are among the largest users of copper. A single municipality in Minnesota terminated a reservoir treatment program due to environmental pressure, and in so doing reduced the entire state's use of copper surfate for algae control from 145 tons in 1989 to 66 tons in 1990.

Brief Summary Text (13):

Therefore, more effective non-toxic compositions and techniques for purification and clarification of water are clearly needed.

Brief Summary Text (16):

In accordance with the subject invention, introduction into water of coccolithic calcium carbonate in combination with a flocculent produces flocs which precipitate rapidly and result in clarification of the water. The coccolithic calcium carbonate can be introduced before, simultaneously with, or after the addition of a flocculent.

Brief Summary Text (25):

The subject invention includes a novel method for the treatment of water contaminated with certain chemicals, micro-algae, other microorganisms, or other suspended particles. More specifically, water containing these contaminants can be effectively treated by application of coccolithic calcium carbonate preceded by, used simultaneously with, or followed by application of flocculents such as aluminum salts or iron salts. It is apparent from this disclosure that the subject invention can have a variety of applications. These include treatment of sewage to remove contaminants and suspended solids. The subject method can also be used to clarify or otherwise purify a lake or other body of water and also can be used in a process to provide potable water. Other obvious variations are also intended to be part of this invention.

Brief Summary Text (34):

One advantage of this combined treatment method over treatment with aluminum salts or other flocculents alone is that the pH is stabilized in a very favorable range between about pH 7 and pH 8.5. The chemical nature of the coccolithic calcium carbonate buffers any present organic or mineral acids. Stabilization of the pH occurs in a range of 7.0 to 8.5 in the water-sediment transition layer, which is a very favorable pH range for the activity of many aquatic microorganisms. This pH

buffer effect also counteracts the internal recycling of phosphates which become soluble at low pH values and are therefore released from the sediments into the main water body when the pH drops below 6. Also, the toxicity or other potentially harmful effects of these metal ions are eliminated because substantially all of the aluminum ions introduced into the aquatic system are precipitated or flocculated by the excess quantities of coccolithic calcium carbonate and are therefore transformed into insoluble forms. Coccolithic calcium carbonate in the presence of copper salts and/or other substances currently in use for water treatment produces the same effect. Accordingly, the coccolithic calcium carbonate can be used for detoxifying aquatic environments after use of metal salts or other potentially harmful substances which are bound and precipitate in the formed floc.

Detailed Description Text (3):

Coccolithic calcium carbonate was added to the algae-enriched water samples, either as a dry powder or as a slurry containing between 50 and 800 grams of coccolithic calcium carbonate per liter of aqueous suspension. Mixing was done by mechanical or manual stirring and/or by air injection until a homogeneous suspension of coccolithic calcium carbonate was obtained. Any means for mixing the component into the water is sufficient. Upon addition of the "accelerator" (flocculent), e.g., aluminum salt, iron salt, or the like, sedimentation began within 30 seconds and was complete within about 300 seconds. Similar effects were obtained by first adding the flocculent and thereafter the coccolithic calcium carbonate. In order to stabilize pH when flocculent was added first, best results were obtained by adding the coccolithic calcium carbonate within 5 minutes after the accelerator treatment.

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L9: Entry 7 of 10

File: USPT

Feb 18, 1992

DOCUMENT-IDENTIFIER: US 5089120 A

**** See image for Certificate of Correction ****

TITLE: Treatment vessel for bodies of water with laterally adjustable pontoons

Brief Summary Text (14):

Other additions which may be made to lakes and other bodies of water at various times may be algacides, such as copper sulfate, to kill excessive algae, fertilizers to encourage the growth of photosynthetic and other fish food, general or specific herbicides to kill excessive or deleterious multicellular plant growth, disinfectants or poisons to sterilize a body of water and other treatment agents for various specialized purposes.

Brief Summary Text (15):

One method of counteracting the acid rain and acid lake problems is by neutralization of the affected lakes and other bodies of water by various neutralizing agents. Rehabilitation of surface waters has been experimentally practiced with a number of reagents, including lye, sodium carbonate, calcitic and dolomitic limestones, hydrated lime, quicklime and slurried industrial slags, which are essentially calcitic or dolomitic lime material. Calcitic limestone has proved for a number of reasons to be the material of choice, particularly since it is readily available and relatively cheap. Calcitic limestone is comprised primarily of calcium carbonate and is a natural solution component of many lakes and streams where it acts as a buffering agent. Calcitic limestone also has a moderate reactivity which protects fish against so called pH shock. It may also be relatively easily prepared in slurries or solutions applicable to a variety of acidic conditions.

Detailed Description Text (37):

As indicated briefly hereinabove one of the many treatment agents which can be applied to lakes and other bodies of water in accordance with the present invention is alum or trivalent aluminum sulfate applied to precipitate and/or control redissolution of phosphorus in the water to control eutrophication due to excess nutrients in the water. The trivalent aluminum sulfate, sometimes referred to as "papermaker's alum", since it is not technically a real alum, which is a double sulfate salt, reacts under proper pH conditions both with dissolved phosphorus in the water to form insoluble aluminum phosphate and with the water forming a flocculent or colloidal precipitate of aluminum hydroxide which absorbs inorganic and entraps particulate phosphorus in the water which then settles with the floc to the bottom. Trivalent aluminum sulfate is widely used not only to precipitate phosphorus, but as a settling agent in general to clarify water by bringing down or settling fine colloidal materials of many kinds. The aluminum hydroxide formed with an excess of water upon the application of alum material within certain pH ranges is a flocculent or gelatinous substance which readily becomes engaged with other solids in the water and precipitates them along with itself.

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L9: Entry 8 of 10

File: USPT

Nov 21, 1989

DOCUMENT-IDENTIFIER: US 4882072 A

**** See image for Certificate of Correction ****

TITLE: Method and apparatus for treating bodies of water

Brief Summary Text (14):

Other additions which may be made to lakes and other bodies of water at various times may be algacides, such as copper sulfate, to kill excessive algae, fertilizers to encourage the growth of photosynthetic and other fish food, general or specific herbicides to kill excessive or deleterious multicellular plant growth, disinfectants or poisons to sterilize a body of water and other treatment agents for various specialized purposes.

Brief Summary Text (15):

One method of counteracting the acid rain and acid lake problems is by neutralization of the affected lakes and other bodies of water by various neutralizing agents. Rehabilitation of surface waters has been experimentally practiced with a number of reagents, including lye, sodium carbonate, calcitic and dolomitic limestones, hydrated lime, quicklime and slurried industrial slags, which are essentially calcitic or dolomitic lime material. Calcitic limestone has proved for a number of reasons to be the material of choice, particularly since it is readily available and relatively cheap. Calcitic limestone is comprised primarily of calcium carbonate and is a natural solution component of many lakes and streams where it acts as a buffering agent. Calcitic limestone also has a moderate reactivity which protects fish against so called pH shock. It may also be relatively easily prepared in slurries or solutions applicable to a variety of acidic conditions.

Detailed Description Text (44):

As indicated briefly hereinabove one of the many treatment agents which can be applied to lakes and other bodies of water in accordance with the present invention is alum or trivalent aluminum sulfate applied to precipitate and/or control redissolution of phosphorus in the water to control eutrophication due to excess nutrients in the water. The trivalent aluminum sulfate, sometimes referred to as "papermaker's alum", since it is not technically a real alum, which is a double sulfate salt, reacts under proper pH conditions both with dissolved phosphorus in the water to form insoluble aluminum phosphate and with the water forming a flocculent or colloidal precipitate of aluminum hydroxide which absorbs inorganic and entraps particulate phosphorus in the water which then settles with the floc to the bottom. Trivalent aluminum sulfate is widely used not only to precipitate phosphorus, but as a settling agent in general to clarify water by bringing down or settling fine colloidal materials of many kinds. The aluminum hydroxide formed with an excess of water upon the application of alum material within certain pH ranges is a flocculent or gelatinous substance which readily becomes engaged with other solids in the water and precipitates them along with itself.

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L9: Entry 9 of 10

File: USPT

Oct 31, 1989

DOCUMENT-IDENTIFIER: US 4877524 A

TITLE: Apparatus for treating bodies of water

Brief Summary Text (14):

Other additions which may be made to lakes and other bodies of water at various times may be algacides, such as copper sulfate, to kill excessive algae, fertilizers to encourage the growth of photosynthetic and other fish food, general or specific herbicides to kill excessive or deleterious multicellular plant growth, disinfectants or poisons to sterilize a body of water and other treatment agents for various specialized purposes.

Brief Summary Text (15):

One method of counteracting the acid rain and acid lake problems is by neutralization of the affected lakes and other bodies of water by various neutralizing agents. Rehabilitation of surface waters has been experimentally practiced with a number of reagents, including lye, sodium carbonate, calcitic and dolomitic limestones, hydrated lime, quicklime and slurried industrial slags, which are essentially calcitic or dolomitic lime material. Calcitic limestone has proved for a number of reasons to be the material of choice, particularly since it is readily available and relatively cheap. Calcitic limestone is comprised primarily of calcium carbonate and is a natural solution component of many lakes and streams where it acts as a buffering agent. Calcitic limestone also has a moderate reactivity which protects fish against so called pH shock. It may also be relatively easily prepared in slurries or solutions applicable to a variety of acidic conditions.

Detailed Description Text (41):

As indicated briefly hereinabove one of the many treatment agents which can be applied to lakes and other bodies of water in accordance with the present invention is alum or trivalent aluminum sulfate applied to precipitate and/or control redissolution of phosphorus in the water to control eutrophication due to excess nutrients in the water. The trivalent aluminum sulfate, sometimes referred to as "papermaker's alum", since it is not technically a real alum, which is a double sulfate salt, reacts under proper pH conditions both with dissolved phosphorus in the water to form insoluble aluminum phosphate and with the water forming a flocculent or colloidal precipitate of aluminum hydroxide which absorbs inorganic and entraps particulate phosphorus in the water which then settles with the floc to the bottom. Trivalent aluminum sulfate is widely used not only to precipitate phosphorus, but as a settling agent in general to clarify water by bringing down or settling fine colloidal materials of many kinds. The aluminum hydroxide formed with an excess of water upon the application of alum material within certain pH ranges is a flocculent or gelatinous substance which readily becomes engaged with other solids in the water and precipitates them along with itself.

Detailed Description Text (101):

(1) algacide (i) copper sulfate